CHANNELLED CASSETTE FOR GEL ELECTROPHORESIS

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ABSTRACT

The present invention comprises a cassette assembly comprising a base plate with channels to retain gels and an outer plate removably attached to the base plate to form closed chambers within the gel cassette. A disposed gel is disposed within the cassette and subsequently eluted to resolve various samples loaded within each chamber. The outer plate is removed and the gel columns are exposed along the open face regions of the channels of the base plate. The gels are developed within the channels of the base plate as developing solutions communicate with the gel to form an image thereon.

FIELD OF INVENTION

The present invention relates to a gel cassette and method of using the gel cassette in the field of electrophoresis where the present invention retains a polymerized gel within the cassette during the gel development stage.

BACKGROUND OF THE INVENTION

By the use of gel electrophoresis methods and devices, various molecular species such as proteins and deoxyribonucleic acids (DNA) can be separated by charge and molecular weight. Gels in the form of slab or tube are often polymerized within single chamber cassettes formed by two plates assembled together with spacers in between to form a void volume therein. Sample molecular species are loaded into loading wells on gel slabs or tubes and are separated during the gel elution stage where a buffer solution moves across the gel matrix carrying samples to varying distances. Subsequently, the gels are developed by several conventional staining methods such as silver stains, negative stains, fluorescent stains, coomassie stains, IEF stains, blotting stains, and nucleic acid stains. These stains are used to visualize the migration of resolved species. The staining or dyeing processes require the exchange of solutions according to different development stages. A typical silver stain development of a gel involves a fixing stage, staining stage, and a stopping stage. During the development stages, the gels are removed from the cassettes and treated in their naked condition. The gels, being composed of polyacrylamide or other conventional polymeric material, are fragile and require care in handling especially for low percentage polyacrylamide or agarose gels. Current gel cassettes are made only for the gel elution stage, whereafter, the gel is removed from the cassette and developed separately as a naked gel placed inside containers having appropriate fluids. Current gel cassettes as claimed by U.S. Pat. 5,228,970 (Foley), U.S. Pat. 5,149,417 (Foley et al.), U.S. Pat. 4,929,329 (Danby et al.),

U.S. Pat. 6,001,233 (Levy), U.S. Pat. 5,888,369 (Tippins et al.), U.S. Pat. 5,882,495 (Garrels), U.S. Pat. 4,417,967 (Ledley), U.S. Pat. 5,685,967 (Manis et al.), and U.S. Pat 6,013,165 (Wiktorowicz et al.) comprise basically two flat plates secured to each other with spacers in between as to form a void volume for housing a gel. These references as well as WO9301491 (Boquet et al.) are hereforth incorporated by reference in their entirety. Many problems exist with developing naked gels. The fragileness of gels make it easy to damage them during processing. Additionally, keeping naked gels separate during development limits the quantity of gels that can be simultaneously developed. Furthermore, naked gels that move around during gel development make it difficult to visually monitor. What is clearly needed is a gel retaining cassette that can be used for the elution stage and thereafter developed within the cassette during the gel development stage as to minimize direct handling of the gel and to increase the throughput potential of gels.

SUMMARY OF THE INVENTION

The present invention comprises a gel cassette having channels formed on the base plate or extruded as a single piece as the base plate wherein a gel is retained while exposed to fluids along the open face regions. These channels are parallel to one another and extend longitudinally across the base plate for a substantial length of the base plate. The gel is initially disposed into the gel cassette with the outer plate removably secured to the base plate, thereby covering the open face regions of the channels and forming

closed chambers running parallel to each other between the base plate and the outer plate. The opening at the bottom end of the chamber is sealed while the opening at the top is open to receive a polymerizing gel solution. A void volume is left at the top of each chamber allowing a sample to be loaded above the polymerized gel. After the samples are loaded into the chambers, the secured cassette assembly is placed within a gel elution system and the samples are eluted and resolved across the gel. Thereafter, the adhesive material, which attaches the outer plate to the base plate, is removed, thereby exposing the base plate with gels retained within each channel yet exposing the gels along the open face regions. Developing solutions communicate with the gel through open face regions while being stabilized within the confines of the channels of the cassette thereby minimizing the risk of damaging the gels and increasing the throughput potential.

DESCRIPTION OF THE FIGURES

FIG. 1 shows a plan view of a certain preferred embodiment of the present gel cassette invention.

FIG. 2 shows a top view of the gel cassette where the outer plate **2** is detached from the T rails **7**.

FIG. 3 shows a top view of the gel cassette where the outer plate **2** is secured to the base plate thereby forming closed chambers **6** which are formed by the void space created the T rails and the secured outer plate over the T rails.

FIG. 4 shows a plan view of another preferred embodiment wherein a separating mid section **8** forms two regions of chambers on the gel cassette.

FIG. 5 shows a close up of an indent cavity **9** formed on the base plate between two T rails.

FIG. 6 shows a cut away profile view of a T rail having an opening **10**.

FIG. 7 shows possible positions of these T rail openings, the left displaying openings in a horizontal position and the right displaying a diagonal arrangement.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

In a certain preferred embodiment as shown in FIG. 1, the gel cassette of the present invention comprises a base plate **1** having channels with an open face region whereupon an outer plate **2** is removably secured to the base plate **1** by adhesives **3**, thereafter forming closed chambers **6** in the void space between the base plate and the outer plate **2**. The channels can be formed by attaching T rails **7** onto the base plate or forming the channels and the base plate as a single solid piece by an extrusion process. The channels can also be formed by attaching rail blocks to the base plate and subsequently attaching flat plates to the raised blocks to form a T rail. Alternatively, the rail blocks may be extruded as a single piece with the base plate to which the flat plates can be subsequently attached. FIG. 2 shows the cassette of FIG 1. wherein the outer plate

6 is detached from the base plate thereby showing the channels having an open face region.

FIG. 3 shows the same cassette wherein the outer plate **2** is secured to the base plate **1** forming closed chambers therein. A gel polymerizing solution is disposed within the closed chamber through an opening on the top while an adhesive or sealing material shown in **4** of FIG. 1 seals the opening **5** at the opposite end of the chamber.

In another preferred embodiment shown in FIG 6, the T rails have an opening **10** that allows the disposed gel polymerizing solution to flow and communicate between the closed chambers. In yet another further preferred embodiment shown in FIG. 5, the base plate **1** has indention cavities **9** which serve to prevent a subsequently polymerized gel from moving or sliding within the channel during agitation or processing of the gel.

In another certain preferred embodiment shown in FIG. 7, the T rail openings **10** are positioned in a horizontal manner or in a diagonal manner.

In still another preferred embodiment shown in FIG 4, the base plate **1** is divided into two channel regions along a mid dividing section **8,** which allows the outer plate to be removably secured along the mid section **8** as well as the peripheral edges where the outer plate **2** meets or contacts the base plate **1** as shown in by the position of the adhesive **3** of FIG 1.

A typical use of any of the above mentioned embodiments involves disposing a polymerizing solution into the closed chambers and thereafter forming separate sample running lanes within each chamber. Each chamber becomes a miniature gel column where samples can be loaded above and resolved through the gel medium during gel electrophoresis (gel elution stage). Subsequently, the outer plate is removed and the gel